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Research Article

Evaluation Grids for Endodontics Preclinical Practical Activities

Jalila Dakkaki, Sofia Drouri, Sara Dhoum, Rachida Mayou, and Mouna Jabri

Department of Conservative Dentistry and Endodontics, School of Dental Medicine, Hassan II University, Casablanca, Morocco

Correspondence should be addressed to Sara Dhoum; saradhoum@hotmail.com and Rachida Mayou; docteur.rachida@gmail.com

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Preclinical practical activities (PPAs) are an important part of undergraduate dental education. They are a type of teaching based on practical learning. As a result, the Department of Conservative Dentistry of the Faculty of Dentistry of Casablanca provides endodontic activity sessions for third-year students; the objective is to develop the students' manual dexterity and prepare them for clinical practice. During these sessions, students are required to perform the various stages of endodontic treatment from taking preoperative radiographs to root canal filling, including the creation of the access cavity and root canal preparation. At the end of the treatment, the act performed is evaluated in its entirety. This evaluation is very often considered to be the final activity of a teaching course, which makes it possible to assess the knowledge and practical aptitude of each student. This approach allows neither the teacher to objectively evaluate the acts performed nor the student to identify his/her difficulties. Concerned by the pitfalls of the methods of evaluation adopted during these activities, we thought about the development of criterion-referenced evaluation grids in order to remedy the subjectivity of the teacher's assessment and to enable the student to improve his learning.

1. Introduction

The evaluation of learning among university students is a fundamental and inseparable step in the educational process and should guarantee the future professional an optimal level of training. In 2000, A. Harrouchi showed that evaluation is an essential factor in learning, since it encourages students to learn and guides and facilitates their learning [1].

Indeed, students change the way they learn in order to develop skills and be well prepared for all types of evidence. However, in the absence of feedback that encourages exchange and discussion, evaluation will be meaningless. The evaluation at the end of the learning path, based solely on grades and sometimes late results, does not usefully inform the student and/or the teacher about the learner's learning process [2].

The literature review suggests that the scope of evaluation is one of the most complex aspects of teaching. The work of Pellegrino, Chudowsky, and Glaser illustrates this complexity well through a model that divides the evaluation process into three stages [3]:

(i) Clarification of learning targeted by evaluation.

(ii) The choice of the method for observing the evidence of this learning.

(iii) The development of an interpretation process in order to analyse this evidence, in other words, the development and use of tools to determine the degree of attainment of the objectives set.

Although some subjectivity may take shape during the clarification and observation stages, most of it emerges during the interpretation stage. In this latter phase, the use of criterion-referenced grids is proving to be a method that is gaining popularity in university teaching. By forcing the development of explicit evaluation criteria, such grids can reduce measurement errors and thus reduce the subjectivity of the way students' work as viewed [4].

This should lead teachers, especially those at the beginning of their careers who are often unfamiliar with evaluation, to revisit their practices with regard to the assessment of student learnings. Thus, teachers must design criterion-referenced evaluation grids that not only adequately measure the objectives aimed by the courses they produce, but also make it possible to assess the intellectual progress of the apprentices they support.

The present work relates the description of a new evaluation device in the form of grids, proposed during the sessions of the practical preclinical endodontic activities (PPAs) at the Faculty of Dentistry of Casablanca.

2. Evaluation and Teaching

The evaluation of university students' learnings is a fundamental step in the educational process. It tests what the student is learning and how he or she is learning. Its main objective in teaching is to certify the acquired knowledge and thus to guarantee the future professional an optimal level of training course. It involves the institutions which are the origin of the training and which control the finished product [5]. According to Jouquan, evaluation is central to the teaching and learning process. He adds that it is preferable to give priority to evaluation systems that promote in-depth learning. That is, those that call for the relevant reuse of knowledge rather than recitation [5, 6].

Evaluation is one of the main determinants of the quality of learning and requires particular attention from the initial design of training actions. Thus, the nature of the tasks to be evaluated and the criteria that will be taken into account for correction and/or determination of success must be made explicit to students from the very beginning of the teaching and learning session. This can only be done through devices that use methods and instruments that are mastered and whose strengths and limitations are known [5, 6].

2.1. The Different Modes of Evaluation. The modalities of evaluation largely determine the nature and quality of the learning that students develop. It is highly likely that we can significantly influence learnings by using the various types of evaluation without changing teaching procedures [7]. Generally speaking, there are three forms of evaluation that correspond to several distinct moments in learning; namely,

(1) Diagnostic evaluation takes place at the beginning of the learning sequence. It makes it possible to take stock of the learner's achievements and knowledge. In fact, this evaluation process is used to judge the prior learnings of learners at the beginning of a learning cycle and allow guiding the student in his or her choices. It also allows their mental representations to emerge spontaneously in order to eventually modify their knowledge and set more individualized learning objectives [8, 9].

(2) Formative evaluation: the concept of formative evaluation was introduced by Scriven in 1967 and extended to pupils and students by Bloom in 1971 [8–11]. This type of evaluation takes place during the learning process and makes it possible to characterize a learner's performance in relation to preestablished objectives, and then to organize, as a result, the regulation of the pedagogical system. Moreover, the main objective of this type of evaluation is to contribute to the improvement of learning in courses and in practical work, by informing the teacher about the relevance of his methods and the learner about his own path and the means by which he will be able to overcome his difficulties in order to get closer to the set objective. According to De Landsheere, evaluation is normally carried out at the end of each learning task and its purpose is to inform the student and the teacher of the degree of mastery achieved and possibly to find out where and how a student is struggling, in order to suggest or introduce strategies to the student to help them progress [12].

(3) Summative or certificate evaluation: this takes place at the end of a teaching sequence in order to judge the degree and value of the learnings achieved by the student and is most often used to decide on his or her success or failure. It is often norm-referenced and then leads to a ranking of students according to their skills and performance [8, 9].

Furthermore, we can distinguish two types of evaluation according to the type of referent and whose difference lies in the way in which the results are interpreted. A distinction can be made as follows:

(1) A norm-referenced evaluation that ranks subjects in relation to an average level of a reference group: norm-referenced tests make it possible to situate students in relation to each other, often in order to make a selection. This evaluation is characterized by a lack of transparency on what has been learned since it only makes it possible to know which students have learned best. In certain situations, the gain in knowledge of students who fail is identical to that of students who succeed with honors [13].

(2) Criterion-referenced evaluation, which is characterized by the fact that the student is assessed independently of others: it is based on the gap between what is mainly expected and sought and the student's performance. Thus, it provides information on the level of performance achieved by the student alone. It will allow not only an objective evaluation of the acts performed by the students but also a self-evaluation of the latter while having an idea of the difficulties encountered during their learning [13]. Minder stipulates that a criterion-referenced evaluation ensures the transparency of the process for all those involved. It is indeed a question of assessing a behaviour by situating it in relation to a target [14]. It should be emphasized that criterion-referenced evaluation goes hand in hand with any type of evaluation, particularly

formative evaluation, since the progress of each student in his or her learning process must be guided by clearly identified paths. Thus, the definition of explicit criteria through adapted tools is necessary to assess the quality of the product. This is the case with criterion-referenced grids, which allow for a better definition of the evaluation criteria and the levels of performance that correspond to them.

2.2. Evaluation Grids. The criterion-referenced grids intervene successively at several points in the process of developing and evaluating lessons. Before the preparation of the courses, they facilitate the structuring of the sessions and make it possible to think about a didactic progression of the whole according to clear objectives which they oblige to define in advance. This point is all the more important when it is a question of mobilising different types of knowledge. At the beginning of the learning sequence, they contribute to the reciprocal calibration of teachers' requirements and students' expectations. During the course of the sessions, they make it possible to provide systematic feedback on the students' performance and often lead to improvements in the latter. At the end of the task, the criterion-referenced grids should be the subject of a specific rubric in the overall evaluation of the students [4, 15].

They appeared at the beginning of the 20th century with the emergence of the positivist current of quantifying learning, particularly through the development of psychometric tests aimed at reducing subjectivity and differences between evaluators [16, 17]. According to several authors, including Scalon, the evaluation grid is a tool that can help form a judgment on complex learning, such as a performance or the completion of a process that cannot be judged simply as good or bad as in the case of a question with objective correction [18].

Integrated more formally into the field of education in the 1960s, their popularity peaked in the late 1990s. It is a tool in the form of a table that details both the criteria used to interpret evidence of learning provided by the student and the possible levels of performance for each criterion. This makes it easier to assign a value to each output during assessment. It can be useful in assessing the knowledge and skills that students demonstrate through an oral presentation, an assignment or a written work, a lab manipulation, or a group project [15–17].

The reliability of the assessment is increased because the teacher's judgment is more invariable from one student to another, regardless of when or by whom the assessment is made, provided that the various assessors have discussed the grid. It will therefore be a baseline that allows for a common attitude on the part of the evaluators and the necessary readjustments on the part of the students. This reduction in the subjectivity of the evaluation is due to the fact that teachers, when using a criterion-referenced grid, are obliged to explicitly review each of the judgment criteria, the dimensions evaluated, and their reasoned synthesis. The clear identification of the objectives thus set makes it possible to better frame student performance, reduce ambivalence in marking, and increase the fairness of the marks awarded [4, 19].

In addition, it provides students with accurate information on all the variables they need to pay attention to during a learning sequence. It allows them to target the elements they need to remedy in order to achieve the expected performance. In doing so, it is a valuable tool for communication between teachers and students. It increases transparency and reduces uncertainty about the communication of teaching objectives and the interpretation of learning evidence during training. Indeed, some authors have found that the use of this tool has improved the communication of the learning that students are required to demonstrate on assessment. Results are generally improved, as is teacher and student satisfaction [15]. Certainly, in the exchanges between the ones and the others, the criterion-referenced grid takes the place of the didactic common sense shared by all the participants of teaching. It thus makes it possible to offer more concise feedback and avoid a large number of misunderstandings. Prior to the planning of a task to be assessed, a criterion-referenced grid helps the teacher to clarify the instructions for a piece of work and even to increase the level of difficulty of the work [15].

It is particularly interesting to note that criterion-referenced grids can be used at various points in the teaching process. Thus, it is possible to use the grid during exercises during or outside the class. Students may even be asked to evaluate themselves or their peers, during the semester when formative evaluations take place. The advantage of such an approach is that it allows students to direct their learning through an explicit and systematic identification of their strengths and weaknesses. This generally develops their reflective skills in what they are learning and allows them to adjust their learning according to the results obtained in the self-evaluation.

A well-constructed grid then becomes a tool that will help both the teacher to better specify his expectations and the student to know them. However, criterion-referenced grids are not a panacea, if only because of the significant investment required of the teacher who develops such a tool. Some authors identify possible pitfalls in their design, particularly in clarifying and establishing descriptive scales that can be clearly and unequivocally distinguished. According to Martin et al., evaluation grids limit creativity and intellectual reflection because of the relatively detailed specification of requirements [15].

In the end, the value of the grid is highly contingent on its use and making it available is not enough. It still needs to be introduced and explained, and students need to be accompanied and guided to make it meaningful in the context of the exercise requested.

2.2.1. Design of a Criterion-Referenced Evaluation Grid. The statements of various authors stipulate that the evaluation grid should be adapted to the conditions under which the evaluator will have to make his or her judgment. In situations where the evaluator must make an immediate

decision to correct the learners' work, the tool must be easy to use. It is also important to clearly structure the task that will be proposed to the students before developing the evaluation grid. This will allow each student to benefit from the same conditions [20].

Thus, before developing or adapting an evaluation grid, it is important to specify the context in which this tool will be used. In addition, it is necessary to define the learning to be evaluated as well as its goals. That is, the tasks that students will have to accomplish in order to demonstrate what they have learned or what they can do. The characteristics and number of students to be assessed should also be taken into account [20].

Furthermore, it is important to clarify the purpose of the evaluation. If it is envisaged from a formative and learning support perspective and if necessary, an adjustment of teaching, the evaluation grid will be quite detailed. This will allow a judgment to be made on each criterion and provide feedback to students based on the degree of achievement of each of them. When the purpose of the evaluation is to make a final judgment on the learning achieved at the end of a learning sequence, the evaluator will want to do so in a global manner. In this case, the evaluation grid may be less detailed and it will be constructed in such a way as to make an overall judgment and not only a judgment by criterion [20].

2.3. Selection of Criteria and Observable Elements. According to Legendre, the evaluation criterion is a quality or standard against which a judgment is made. It is a point of reference to which one refers when deciding on the value of the object being evaluated [21]. The criteria retained must be relevant to what is to be evaluated. In other words, they must make it possible to decide on the main qualities, dimensions, or behaviours that characterize what is being evaluated. Ideally, the choice of evaluation criteria for summative evaluations should be made by individuals who are likely to evaluate the same learning and who have a good mastery of the learning being evaluated. In the daily context of his or her teaching, a teacher is able to define these criteria himself or herself. However, validation with colleagues can be done to confirm the choices made [19, 20].

In order to determine the evaluation criteria, one must first draw up a list of observable elements that express the product, process, or attitude that one wants to observe using the evaluation grid. It is from the observable elements that these criteria can be inferred. This list is generally too abundant, since it contains many criteria that cover the same standards under different names. This requires further analysis and choices to be made before the final selection is made. It should be noted that there are no strict rules for determining the number of evaluation criteria to be used. However, when the number of criteria is too high, there is a risk of losing sight of the object being evaluated. If too many details are taken into consideration, it is possible that secondary elements will be assessed at the expense of the more important dimensions of the learnings to be assessed. The criteria retained should describe the observable elements to be measured in a comprehensive manner and should be independent of each other. They are formulated by writing a short description of the observable element using action verbs conjugated in the present tense and the affirmative form. Whenever necessary and possible, particularly in the case of the evaluation of a process or approach, the criteria are presented in the order of appearance of the elements to be observed [15, 20].

2.4. The Appreciation Scale. According to Scalon, the appreciation scale is a succession of graduated elements, from left to right by convention, called steps, which correspond to various degrees of possession of the quality sought by the criterion. In fact, it is the part of the grid that is in the form of a continuum that indicates the attained level of the competency being assessed. The number of steps may vary depending on the intent, the evaluation criterion, and the level of precision sought. The literature review showed that the sensitivity of the four- and six-step scales varies very little. In fact, only three benchmarks are required to create a scale that is easy and effective to use [20, 22, 23].

There are different kinds of appreciation scales. Uniform scales are the most common and can be quantitative or qualitative. Quantitative uniform scales show a progression that allows a judgment to be made on the task being assessed, expressed in numerical, alphabetical, graphical, or pictorial values [20]. The numerical scale lends itself well to self-evaluation or to the observation of progress, particularly for correcting productions, such as a research report or a laboratory manipulation. The graphical scale uses a line to represent continuity in the attitude one wishes to evaluate. The teacher then places his or her assessment at any point on the line. The major disadvantage of this type of scale is the difficulty of being consistent from one student to another because of the imprecision of the scale. The pictographic scale uses symbols or pictograms to illustrate the steps. It is preferable to remain constant in the order of the pictograms and to place the positive rating preferably on the far right. Qualitative scales attribute an appreciation to the observed productions, which is formulated in a register of intensity (not at all, a little, a lot, unsatisfactory, satisfactory, very satisfactory). This type of scale is more precise than the numerical scale, but the understanding of the qualities attributed may vary from one assessor to another or even from one case to another for the same observer.

Inspired by American literature, the appreciation scales can be descriptive. They consist of a series of portraits that describe different levels of the quality of a task or behaviour, most often following a continuum of three to six steps [20]. It can be used to assess products, processes, or attitudes. This type of grid should be preferred as it allows for greater fidelity. Indeed, it results in a high degree of concordance between evaluations conducted by different people. It also has the advantage of presenting the student with a detailed and typical description of what he or she must do, produce, or demonstrate while facilitating feedback. However, this scale is more difficult to design. It is important to ensure that the qualifiers used are consistent with the criterion or observable elements [20].

3. Presentation of PPA of Endodontics

Endodontics or the science of treating dental pulp, whether healthy or pathological, is part of the education provided to dental students in Casablanca and begins in the 3rd year of studies. This teaching is organized by the department of CDE.

The theoretical teaching is accompanied by a practical activity which consists in carrying out the different stages that allow applying and completing the knowledge given in theoretical courses. Indeed, they allow the transfer of theoretical knowledge into practical gestures allowing the development of skills specific to the profession of dentistry. During each practical work session, the student puts forward his or her theoretical knowledge to carry out the required work. It is learning through experience that critically reflects the activities in which the students are involved. Having prior knowledge makes it easier to understand the acts to be performed and allows students to seek more advanced knowledge in order to develop their practical skills and to avoid repeating the explanation of concepts already seen.

Numerous studies have shown the difficulty students have in reusing their theoretical knowledge during practical sessions, either during practical work or during patient management in the clinic [24]. Indeed, in addition to the intrinsic difficulty of the endodontic act and the overall management of the patient, there are additional technical obstacles such as the patient's mouth opening or the clutter of instruments. They very often oblige the professional to work with indirect vision in a mirror or in a blind manner. These techniques require a long apprenticeship in order to be able to master one's gestures in such situations. The teaching of endodontics is formalized by objectives that are of three orders. They concern the knowledge of the equipment and materials necessary to perform an endodontic procedure, the knowledge of dental anatomy, and its possible variations and finally the knowledge of the different stages of treatment of pulp pathologies and those associated with the tissues supporting the tooth [24–27].

3.1. Conduct of a PPA Session. This activity is organized at the rate of one session per week of 2 hours 30 minutes per student. Students are divided into 4 to 5 groups depending on the class headcount under the responsibility of the professors assisted by specialists, residents, and interns. The endodontics PPA semester is the fifth semester S5 with an hourly volume of 35 hours.

An endodontics PPA session includes a presentation in the form of a talk, a demonstration of the operating protocol which can be supplemented or replaced by a videogram. The necessary prerequisites are essentially based on the assimilation of the lecture courses and directed learnings given in plenary session beforehand. The talk is presented with illustrations, didactic information, photographs, and videograms in the form of a demonstration of the act to be performed. Afterwards, students are required to perform the procedures on natural teeth. The procedure performed is then evaluated by a supervisor who usually gives verbal feedback.

The evaluation of the 3rd year practical endodontic teachings (PPA) is based on a continuous control which represents 60% and a final practical examination in limited time weighted at 40% of the validation mark. Both evaluations determine whether or not the student passes. The latter validates the module if the mark is higher than 10/20. The formative evaluation takes place during the different sessions and aims to report on the progress of the students and to enable them to understand the nature of their mistakes and difficulties encountered. It also makes it possible to estimate the level reached by the student in relation to a standard, to have a means of control by the university authorities and a means of pressure for the teacher. As a result, students can orient their learning behaviour according to grades and assessments and not according to the skills to be acquired.

To overcome this problem, it seems necessary to choose grids as an evaluation tool that appears to be adapted to the evaluation strategy, while meeting the docimological criteria of quality and guaranteeing an objective evaluation. Indeed, the grid can be projected to the students in order to allow them to know the essential criteria to succeed in the different stages of endodontic treatment and thus to argue the marks of the continuous controls. However, this approach must be preceded by some considerations regarding the context in which the criterion-referenced grid is used.

In our context, the definition of an objective frame of reference, which is the criteria for the accomplishment and success of the tasks, as well as the pedagogical objectives, will allow the students to know the goals sought by the endodontics practical teaching and the skills to be acquired at the end of the training. These must be defined for each stage of endodontic treatment.

3.2. Educational Objectives and Criteria for Successful Endodontic Treatment. Endodontic treatment procedures include the following:

(i) Study of the X-rays taken in pre-, per-, postoperative: the radiological interpretation allows identifying the anatomical particularities, to estimate and determine the working length.

(ii) Realization of the endodontic access cavity judged correct by a certain number of criteria: on the one hand, the visual inspection must make it possible to identify the root canal orifices. On the other hand, the dental explorer 17 must be able to slide along the walls without encountering any undercuts. If the dental explorer is hooked in, this indicates that there are still overhangs which must be completely removed. These interferences may hinder the progression of the endodontic instruments to the apical region of the pulp canal. The cavity walls must have some convergence degree to achieve continuity with the walls of the pulp chamber. In addition, the endodontic Rhein probe can be used to check the accessibility of the canals, their orientation, and the integrity of the pulp chamber floor.

(iii) Manual endodontic preparation in continuous rotation: this step is preceded by abundant irrigation of the endodontic access cavity with a sodium hypochlorite solution. It begins with an active exploration of the main canal, also called catheterization. Its main objective is to reach the apical limit while respecting the natural trajectory of the canal and may be the one that requires the most delicacy from the operator. It is conceived as a chemomechanical preparation in which instrumental shaping finds its full significance in influencing the quality of the endodontic cleaning. The most important thing is to obtain a regular and sufficient conicity that is superimposed on the initial trajectory of the main canal, from its coronal to apical part. It is necessary to keep the foraminal diameter as fine as possible and which corresponds to the initial diameter in order to avoid the propulsion of canal debris in the periapex and to ensure the tightness of the canal fillings which are the guarantee of apical healing. Respecting the working length is also a key factor to be favoured. The method determining the working length is based on a radiograph taken with a file placed in the canal at the preoperative length. Interpretation is done on a light table using a magnifying glass. The tip of the file must reach the apical foramen.

(iv) Finally, the tight root canal filling, using the lateral condensation technique, seals the pulp cavity and thus maintains the result obtained. Its control is done by postoperative radiography to observe its aspect in length and density.

The objectives to be acquired will be defined for each stage of the endodontic treatment. Thus, the student must be able to do the following:

(i) Master the technique of taking radiographic images and their interpretation in order to identify the anatomy of the tooth, to identify the existence of anatomical particularities that may cause technical difficulties and to estimate the preoperative working length.

(ii) Identify and prepare the material necessary to perform the procedure scheduled in the PPA session.

(iii) Position the operating field in endodontics.

(iv) Make endodontic access cavities on natural teeth placed on a phantom model to simulate the working positions in the clinic. The students must therefore do the following:

  (i) Draw the cavity of convenience whose shape simulates the morphology of the final cavity and its realization by following the major axis of the crown

  (ii) Remove the pulp chamber ceiling while preserving the shape of the pulp chamber floor

  (iii) Ensure a convergence of the cavity walls while highlighting the root canal orifices

(v) Prepare the main pulp canal by applying the canal shaping techniques taught. To do this, they should do the following:

  (i) Master irrigation protocols and instrumental dynamics

  (ii) Make a first estimate of the working length

  (iii) Obtain a regular and sufficient conicity of the canal from the apex to the canal orifice

  (iv) Respect the original shape of the canal, the position of the apical foramen, and its diameter which must be kept as tight as possible

(vi) Be familiar with the operating protocol for a cold gutta compaction obturation.

Thus, we hypothesized that informative "feedback" associated with a pedagogical system that involves in particular the self-evaluation of students would allow them to evolve in a harmonious and effective way in their learnings. The aim is thus to build the bases of the endodontic skills of the students in practical work. Indeed, it is a question of helping them to build operating diagrams which are articulated around complex psychomotor skills. Hence, there is a need to develop learning strategies that consist in breaking down knowledge relating to these complex activities into simpler sequences in order to be able to interpret them more easily. To this end, we thought of developing two evaluation grids that we integrated into the PPAs in order to improve the efficiency of our teaching. Indeed, the literature review shows that the use of this tool in our discipline has already proven its worth.

In general, the process of developing the evaluation grid involves four steps:

(1) The choice of evaluation criteria and specifying the observable elements

(2) The choice of the appreciation scale with the determination of the evaluation scores

(3) The definition of the way in which the overall judgment will be made

(4) The assembly of the evaluation grid

We have thus worked on two well-defined situations which are, on the one hand, the development of endodontic access ways and, on the other hand, the shaping and filling of the canal. These two tasks, as we have seen previously, meet well-defined and objective criteria. Therefore, we have determined these criteria in a precise and relevant manner in order to improve the accuracy of the informative feedback. Difficulties encountered are also taken into account. Thus, the first grid drawn up constitutes an evaluation sheet that includes three observable elements:

(1) The necessary prerequisites

(2) The quality of the radiogram as well as its reading and interpretation

Table 1: Endodontic access cavity evaluation grid.

Observable elements	Criteria	Scale Score			
		Excellent: 4 points	Satisfactory: 3 points	Unsatisfactory: 2 points	Very insufficient: 1 point
Prerequisites					
Radiogram	Radiogram quality Reading and interpretation				
Shape of the access cavity	Morphology Flaring of the access cavity walls Access to canals and absence of overhangs and dentinal triangles Preservation of the floor of the pulp chamber				

Table 2: Preparation and endodontic filling evaluation grid.

Observable elements	Criteria	Scale Score			
		Excellent: 4 points	Satisfactory: 3 points	Unsatisfactory: 2 points	Very insufficient: 1 point
Endodontic preparation	Catheterization Estimation and respect of the working length Elimination of interference Respect of the canal trajectory				
Root canal filling	Taper of the filling Filling density Complete filling at working length without deviation of the foramen				

(3) The morphology of the endodontic access cavity, the degree of convergence of its walls, the access to the root canals, and the preservation of the pulp chamber floor

The second designed sheet contains two observable elements with eight parameters.

(1) Catheterization during endodontic preparation, estimation, and observance of the working length, elimination of interferences, and respect of the canal trajectory

(2) Taper of the root canal filling and its density and respect to the working length without deviation of the foraminal trajectory

When assembling the grid, we have tried to take a few technical precautions that make the user's task easier and that may contribute to increasing the fidelity of the grid. We have thus established a procedure for weighting each of the criteria, which consists of considering them as units of different values.

Thus, to each score, we matched a number of points "excellent: 4 points, satisfactory: 3 points, unsatisfactory: 2 points, very insufficient: 1 point."

The score assigned to each observable element is obtained by dividing the sum of the points over the number of criteria for this element "prerequisite: 1, radiogram: 2, shape of the access cavity: 4" (Table 1) "endodontic preparation: 4, root canal filling: 3" (Table 2).

The score for the access cavity is obtained by dividing the sum of the scores of the three observable elements in grid 1 (Table 1) divided by three, then multiplied by five to obtain a score out of 20.

The score for root canal preparation and filling is obtained by dividing the sum of the scores of the two observable elements of grid 2 (Table 2) divided by two, then multiplied by five to obtain a score out of 20.

A student who has performed endodontic treatment on a tooth with a high degree of difficulty benefits from one additional point.

The observations that we made during this small experiment, which we consider preliminary, allowed us to see a concrete application of the targeted teachings and learning. The results obtained were in line with the targeted objectives. It seems that the students learned to self-assess in a more fair and precise way. Over the course of the sessions, the students have assimilated the evaluation criteria and we observe that their

average converges with that of the teacher. Thus, making the marking criteria explicit seems to have promoted the ability of students to self-assess. Over these few months of using the third-year preclinical practical activities evaluation grid, we will retain that the majority of students have seen their results progress until they obtain a correct and satisfactory initial practical skill. These observations will then be useful for us to consider a more systematic use of this process in our teaching.

4. Conclusion

Evaluation is a very broad topic that interacts with learning. Changes in evaluation systems have a major impact on the nature and quality of learning. The introduction of criterion-referenced grids will remedy the subjectivity of the evaluation methods adopted in endodontics practical work and consequently enable the student to improve his learning, identify his difficulties at each stage, and evaluate himself while having a critical look at the act performed. However, their construction requires a reflection on the objectives pursued, a selection of relevant criteria, and the choice of a coherent scale in order to assess the quality of the student's performance.

This first experience can take the form of a pilot project with users. It can be judged positive because evaluation using a scale provides a solid framework on which the quality of endodontic performances can be judged while supporting the judgment with an objective score. This can give teachers a sense of confidence in the grades given to students despite the difficulty of scoring to calculate the final grade.

However, we still have to make the effort to generalize the experimentation of these criterion-referenced grids within our department. We are currently focusing on the organization of experience feedback in order to avoid general discouragement. In fact, we are trying to detect the construction flaws and weaknesses of the instrument through correction sessions, because we believe that the ability to construct an evaluation grid develops progressively as it is used. This first experiment is quite conclusive. Nevertheless, it is with the frequency of use that the expected objectives can be achieved.

Data Availability

The authors can confirm that all relevant data are included in the article.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this article.

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